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ML4Sci:
Quantum Contrastive Learning

Project: Learning quantum representations of classical high energy physics data with contrastive learning

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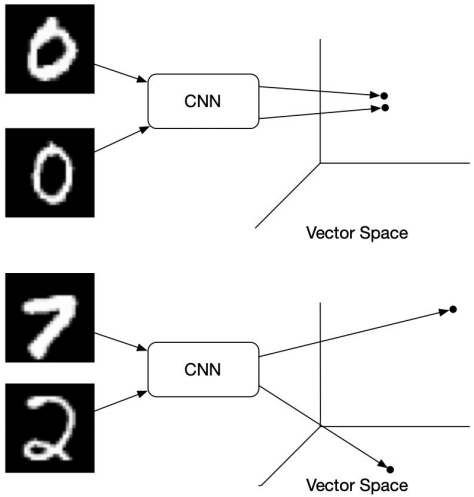
Self Supervised Learning: Contrastive Learning

Contrastive Pair Loss: This loss function aims to minimize the distance between similar pairs and maximize the distance between dissimilar pairs.

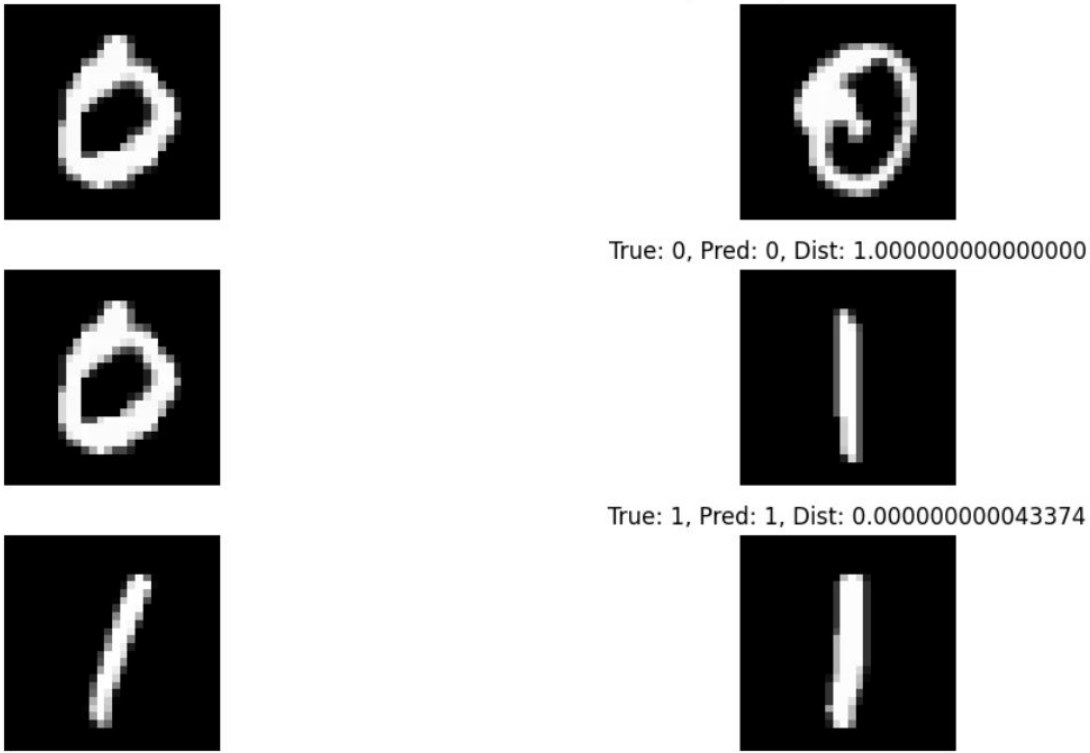
$$L = \frac{1}{2N} \sum_{i=1}^{N} [y_i d_i^2 + (1 - y_i) \max(0, m - d_i)^2]$$



Contrastive Triplet loss: uses triplets of examples: an anchor, a positive (similar to anchor), and a negative (dissimilar to anchor). It ensures that the anchor is closer to the positive than the negative by a margin.

$$L = \sum_{i=1}^{N} [\max(0, d(a_i, p_i) - d(a_i, n_i) + m)]$$

Base Classical Model: CNN + Contrastive Pair Loss



Quantum Embedding

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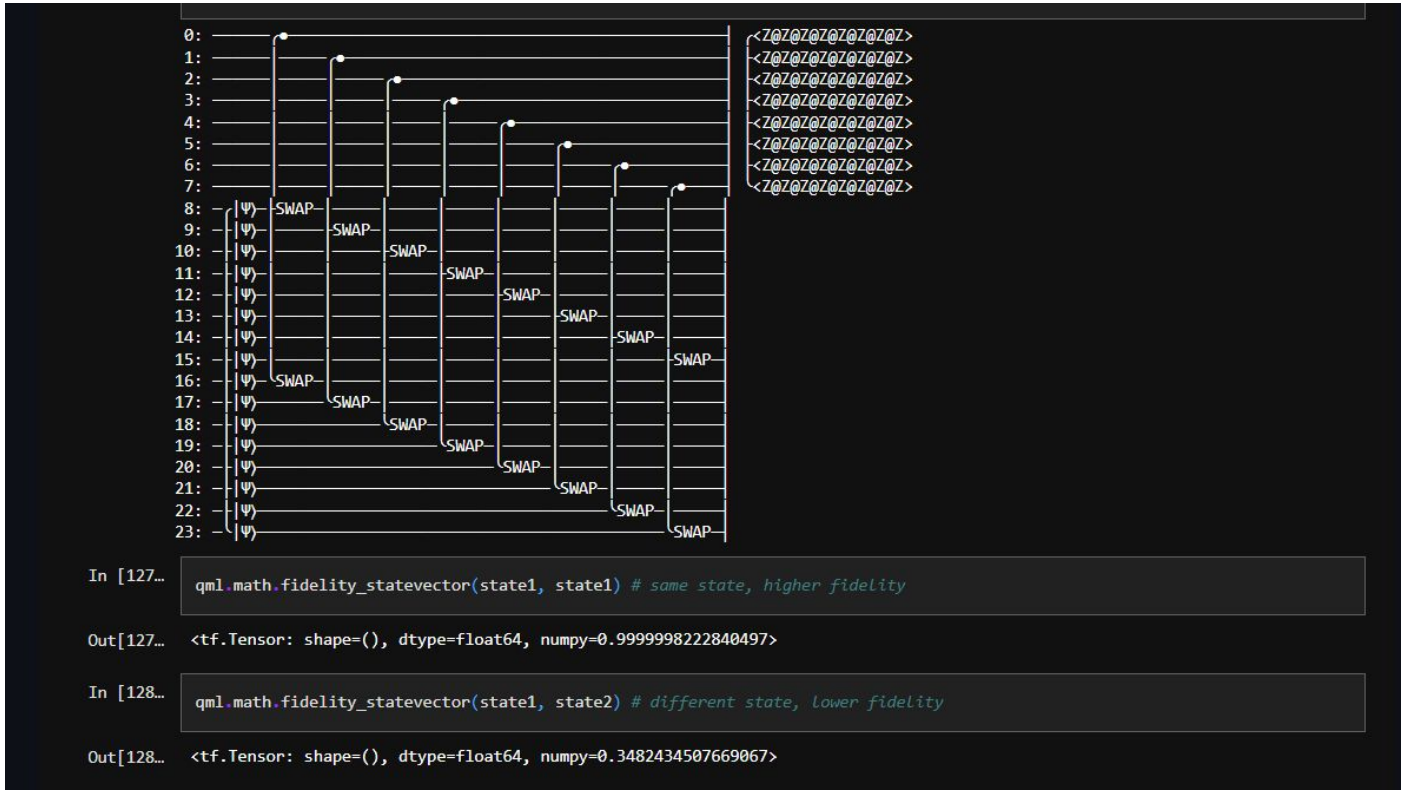

Experimentation: Different Approaches

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